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who, as above stated, recorded large scurs as horns. If the dam was really a hybrid, as I suspect, and the two horned calves in the third group had large scurs instead of horns, the results would agree exactly with the admissible theory that he was a pure poll. On the other hand, no record was made of a number of his get from common cows, so that, on the theory that he was a hybrid, the missing horned calves in group 3 may be the progeny of these unrecorded common cows.

From the above it will be seen that the only results not agreeing closely with theory are doubtful, while in every case where no doubt exists the results are in very satisfactory agreement with theory. These facts render it highly probable that the polled character is a dominant Mendelian unit character.

Dehorning a Breed of Cattle.—Assuming the above conclusion to be true, the dehorning of a breed of cattle is fairly simple. A single hybrid animal would suffice for this purpose, though this would require some inbreeding. It would be better perhaps for several breeders to cooperate, so as to avoid the necessity of inbreeding. An occasional polled animal occurs in all breeds of cattle, and these can be used in such a manner as to produce a new polled breed. In some instances polled animals of other breeds have furnished the starting point, it being possible to transfer the single character desired from one breed to another.

Suppose several breeders secure polled bulls (either pure polls or hybrids) to head their herds. These are bred to large numbers of horned cows. The get of the pure polls will all be polled hybrids, and half the get of the hybrids, in this case, will be polled hybrids. Now, by breeding these polled hybrids together we get one fourth pure polls, one half hybrid polls and one fourth horned. The pure polls thus obtained may become the basis of the future polled herds. The pure polls can be distinguished from the hybrids as follows: In the first place some (may be all) the hybrids will have scurs. In the second place, we may distinguish them by their progeny. Breed the animal to several horned animals; if the progeny are all polled, the polled parent is a

pure poll; if half the progeny are horned, the polled parent is a hybrid.

In the case of males, if we breed to twelve horned cows and secure twelve polled calves, the chances that the male is pure and not a hybrid are 4,096 to 1. (Twelfth power of $2 = 4,096$.) If any of the twelve progeny develop perfect horns the chances are great that the bull is a hybrid.

It is more difficult to determine whether a polled cow is pure or hybrid. If she have scurs, even very small ones, she is hybrid. If not, so far as we now know, she may be either pure or hybrid. If she regularly produces polled calves from horned sires she is pure. But, when breeding for polled animals, it is expensive to test a polled cow in this way. The better plan is to be sure as to the males in all cases and treat all females as pure polls unless they have scurs or horns. In time the horns will disappear from the breed. It is highly important to remember that when a horned calf occurs in a polled breed, either it is a hybrid with horns, a thing not yet certainly known, or *both* of its parents are hybrids. There are undoubtedly a few such hybrids in all polled breeds, and when two such hybrids mate, one fourth of the progeny is horned. The number of such hybrids in a breed may be rapidly reduced by discarding both sire and dam of all horned animals that occur. The same thing will be accomplished less rapidly by discarding only the sires. The occurrence of scurs, but not perfect horns, in an established polled breed indicates that one parent only is hybrid.

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PRELIMINARY NOTES ON THE ARCHEOLOGY OF THE YAKIMA VALLEY, WASHINGTON.¹

Archeological explorations² were made in the Yakima Valley, Washington, for the American Museum of Natural History in the

¹ Published by permission of the trustees of the American Museum of Natural History.

² The first report of these explorations appeared in *The American Museum Journal*, pp. 12-14, Vol. IV., No. 1, January, 1904. It was slightly revised and appeared in *SCIENCE*, N. S., pp. 579-

first part of the field season of 1903. These resulted in the discovery of a number of specimens and human skeletons, as well as the securing of several dozen photographs and a mass of field notes. Other data have been secured, both before the expedition and since, from collections and museums. The following preliminary account is made up from these results which may not be published in full for some time to come.

Central Washington is arid. In most respects the climate resembles that of the southern interior of British Columbia to the north. The summers are perhaps warmer and the winters colder. There is less vegetation and no trees are seen except in river bottoms or where irrigation has been successfully prosecuted. The prehistoric people had no great staples and had to rely upon perhaps even a greater variety of natural products than did the people farther north.

A glance at the linguistic map of Washington shows the great number of tribes inhabiting the general region. This suggests the possibility of the existence of more than one culture area within the same territory, although, of course, we may find several tribes, especially if they be subjected to the same environment, all within one culture area.

Definite age can not be assigned to the archeological finds, since here, as to the north, the remains are found at no great depth or in soil the surface of which is frequently shifted. Some of the graves are known to be of modern Indians, but many of them antedate the advent of the white race in this region or at least contain no objects of European manufacture such as glass beads or iron knives. On the other hand, there was found no positive evidence of the great antiquity of any of the skeletons, artifacts or structures found in the area.

The implements used in securing food include many chipped projectile points of bright-colored agates, chalcedonies and similar stone. Several small quarries of this material with

580, Vol. XIX., No. 484, April 8, 1904, and *Records of the Past*, pp. 119-127, Vol. IV., Part IV., April, 1905.

adjacent workshops were found. While the bulk of the stone used was quite different from the black basalt employed to the north, yet a few points chipped from that material were also found. Points rubbed out of stone or bone were rare. Digging stick handles were seen, but no sap-scrappers were found.

Some small heaps of fresh-water clam shells were examined, but these being only about five feet in diameter and as many inches in depth are hardly to be compared to the immense shell heaps of the coast. Net-sinkers were made by notching and also by grooving pebbles. Such sinkers were very rare to the north and much more numerous here than on the coast, except near the mouth of the Columbia River, where grooved sinkers, usually slightly different from these, are found.

For preparing food pestles were used. These differ from those found either to the north or on the coast, many of them being much longer. Some had tops in the form of animal heads. Fish knives made of slate were not found and, it is believed, pottery was not made in the region.

Sites of ancient semi-underground houses, like those found in the Thompson River region, were photographed. Here, however, stones were seen on top of the embankment. No saucer-shaped depressions were seen, but circles of stones were found, which similarly may mark lodge sites, since the modern Indian has a lodge identical in shape with that found to the north, where saucer-shaped depressions occur. Pairs of arrow-shaft smoothers were seen.

An idea of the ancient form of dress was obtained from a costumed human figure carved in antler.* It had a feather head-dress like that of the present Indians of the region from here to as far east as the Dakotas. The hair

* Figured and described in the *Bulletin of the American Museum of Natural History*, Vol. XX., Article XVI., pp. 195-203, and abstracted in *The Scientific American Supplement*, pp. 23876-8, Vol. LVIII., No. 1490, July 23, 1904, and in *Records of the Past*, l. c. Data has since been secured which verifies most of the conclusions and completes other parts but disproves certain minor speculations.

was dressed and ornamented with dentalium shells. The body is represented as painted and with a fringed apron around the lions. The costume indicated is unlike that of the coast, but resembles those of the plateaus to the south and the plains to the east.

Besides a tubular form of pipe, one type consisting simply of a bowl was found. This is not seen among archeological remains from other parts of the northwest, although pipes used by the Thompson River Indians seem to resemble it. The fact suggests that the culture of this region is somewhat more closely related to that further east than are the cultures of the areas to the north and west.

Art work was found here as in the other areas. The object made of antler, engraved on one surface to represent a human figure in costume, which was found in the grave of a little child, is of good technique and artistic execution. The circle and dot design was common. Paintings⁴ made with red and white on basaltic cliffs, many of which represent human heads with head-dresses and some the whole figure, were also seen. These were made up of lines and were pictographic in character. Sometimes such pictures were made by pecking into the surface of the columns, instead of by painting.⁵ A design, similar to the part of these pictures interpreted as representing the head-dress, was also found pecked into the surface of a grooved net-sinker. Some of the pestles had knobs in the form of animal heads, but in general the art of the region tended to line work of geometric and pictographic patterns. The general style of art shows little resemblance to that of the coast but a strong relationship to that of the plains.

There were three methods of disposing of the dead. In this arid region are stretches of country locally known as 'scab-land,' on which are occasionally groups of low dome-shaped knolls from about fifty to one hundred feet in diameter by three to six feet in height. These knolls consist of fine volcanic ash, and apparently have been left by the wind. This ashy material has been swept from the inter-

⁴ A few of which are figured and described in *loc. cit.*

⁵ *Loc. cit.*

vening surface, leaving the 'scab-land' paved with fragments of basalt imbedded in a hard soil. The prehistoric Indians of this region have used many of these knolls, each as a site for a single grave. These graves, which are located in the tops of the knolls, are usually marked by large river pebbles, or in some cases by fragments of basalt that appear as a circular pavement projecting slightly above the surface of the soil. In one only did we find a box or cyst. This box was formed of thin slabs of basaltic rock, some placed on edge and two large flat slabs covering the cyst so formed. Above this, as was usually the case above the skeletons in this sort of grave, the space was filled with irregular rocks or pebbles. The skeletons were found flexed, on the side. In the graves artifacts, such as dentalium shells, were deposited at the time of burial. Simple graves in the level ground were not found. The rock slides, as in the region to the north, had frequently been used as burial places. In these the skeletons were always in a flexed position. Objects were found to have been placed in some of these graves. Rings of stones were also seen and on excavation within them cremated human remains were found usually several in each circle. In such places dentalium shells, flat shell beads and shell ornaments were usually seen.

The prehistoric culture of the region was apparently similar to that of the present natives.

Numerous evidences were found of the close communication of the people of this culture with tribes of the southern interior of British Columbia. The preponderance of chipped over ground points, digging stick handles, sites of semi-underground houses, pestles with tops in the form of animal heads, pairs of arrow-shaft smoothers, as well as tubular pipes, an incised decoration consisting of a circle with a dot in it and engraved dentalium shells each of a particular kind, besides rock-slide sepulchers and the custom of burying artifacts with the dead, were found to be common to both regions. Certain pestles and clubs made of stone differed from those found in British

Columbia, while the chipped implements were made of a greater variety of stone, and more of beautifully colored material were found. Notched and grooved sinkers were much more common, and sap-scrappers were not found.

Considerable material of the same art as that found in the Dalles region was seen. It is clear that the people living in the Yakima Valley had extensive communication not only with the region northward, as far as the Thompson Valley, but also southward as far as the Dalles of the Columbia. In this connection it is interesting to note that the present Indians of the region travel even more extensively than would be necessary to distribute their artifacts this far.

Much less evidence of contact between the prehistoric people of the coast and that of the Yakima Valley was discovered. Many of the pestles and clubs made of stone were different from those found on the coast, where, it will also be remembered, artifacts were not found with the dead. A pipe,^{*} however, and sea shells of several species were seen. The pipe is clearly of the art of the northwest coast. It was found far up the Toppenish River, one of the western tributaries of the Yakima.

In general the culture of the prehistoric people resembled that of the present natives and was affiliated with the cultures further east, but differed from both the prehistoric and present culture of the coast to the west and even of the southern interior of British Columbia to the north and The Dalles to the south.

From the whole series of archeological explorations, in British Columbia and Washington, begun in 1897 for the Jesup North Pacific Expedition and continued in 1903 for the American Museum of Natural History, we have learned that the material culture of the prehistoric people and the present natives was similar in each area examined; that the culture of the coast is of one sort, that of the interior of southern British Columbia of another; from which that of central Washington

differs somewhat; and that there are several small culture areas lying adjacent to these. We find that each culture apparently developed independently or at least more in accord with its own environment and local tradition rather than with any outside influence, but that at various times, especially in the past, each has been influenced by one or more of the others.

In general the culture of the North Pacific coast does not extend far inland. Northward its limits are unknown, but southward it coalesces with that from the Columbia River in the region between Seattle and Shoalwater Bay. In the interior we have a plateau culture of which, likewise, that part to the north differs somewhat from that to the south.

Experience in this work emphasizes the advisability of conducting archeological investigations in cooperation with students of living tribes. A study of the modern Indian living in a country under investigation usually throws light on archeological finds made there, while an understanding of the antiquities of a region often helps in the study of the present natives. Besides, in this way the continuity of the historical problem is met by a continuity of method.

In selecting successive fields of operation it seems best always to continue explorations in an area so far distant from one already examined that new conditions will be encountered. This will make it probable that new facts will be discovered; possibly a new culture area. At the same time the new field of operations should be near enough that no culture may intervene. Thus the boundaries of culture areas may be determined and new areas discovered. This method of continuation from past fields of exploration allows any experience there gained to be of service in each new and adjacent field, while the discoveries in each new region may always lead to a better understanding of the areas explored and that perhaps in time for incorporation in the results to be published.

It remains to determine the northern, eastern and southern limits of the general plateau culture, how far it may be subdivided into

^{*} Mentioned in *Museums Journal* and SCIENCE, l. c., figured and mentioned in *Records of the Past*, l. c.

local culture areas, the interrelation of each of these, and of each to outside cultures.

But few specimens have been found in the whole area extending from the central Arctic region to the Columbia River, and from there southward along the coast to the Santa Barbara Islands, thence to the Pueblo region and eastward as far as the mounds of the Mississippi Valley. Literature on the archeology of the area is scanty. That whole region, north to the Arctic, across all the plains towards the east, and the plateaus south throughout Nevada, remains to be explored.

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CURRENT NOTES ON METEOROLOGY.

CYCLONIC DISTRIBUTION OF RAINFALL.

MENTION has several times been made in these columns of the great value of discussions of weather elements, not on the basis of monthly and annual averages, but on that of cyclonic control. A further contribution to such investigations is a report by J. A. Udden, 'On the Cyclonic Distribution of Rainfall' (*Augustana Library Publications*, No. 4, 1905). The method employed is the one familiarly known as the composite portrait method. The general region of a cyclone is divided into twenty-five areas, separated by four concentric circles and by a series of eight radii. The precipitation, wind direction and cloudiness shown on the 8 A.M. weather maps for a series of selected stations were entered in the appropriate divisions, and the results then summarized and charted. The stations are Davenport (Iowa), Amarillo, Dodge City, Wichita, Oklahoma, Helena, Miles City, Leander, Boise City, Detroit and Buffalo. In some cases the observations relate to the year 1899 only; in others the period covers several years.

CLIMATIC NOTES ON THE SAHARA.

Last summer Professor E. F. Gautier, of Algiers, crossed the Sahara between Algeria and the Niger River, being the first explorer to cross this wide part of the desert since Laing was murdered near Timbuktu in 1826.

Gautier says that the Sahara, viewed as a

desert, is much less extensive than has generally been believed. The Adrar plateau, from 2,300 to 2,700 feet above sea-level, is not, properly speaking, a waste; and while he was still 360 miles from Gao on the Niger he reached a wide belt of steppe, which is the merging of the Sudan with the Sahara. This steppe region has its rainy season with about six to twelve inches of precipitation every year. This quantity suffices to cover the land with ponds and grass. Animal life is abundant.

Gautier distinguishes between the Tuaregs who ride on camels and those who use horses. The first inhabit the drier regions; the Tuaregs who use horses are on the whole more numerous and live in the steppe region and along the Niger.

The explorer found abundant evidences that this part of the Sahara once had a very large population of the Neolithic period of development. His finds included many arrow-points and axes of polished stone. Even the waste regions were inhabitable until a comparatively recent period. Proofs of this are found in the thousands of drawings upon the rocks, the graves in which, everywhere, the same kinds of implements and other objects were found, and the stones used for grinding grain. These stones show that agriculture was practised here, and that civilization was considerably advanced.

The gradual desiccation of this region advanced from the Sudan. To-day, however, the rain-belt is again extending more and more to the north. Gautier distinguishes these three epochs: the first was marked by dense population; the second by desert conditions, and in the third, or present period, the land is again assuming a steppe-like character. —*Bull. Am. Geogr. Soc.*, Jan., 1906.

METEOROLOGY OF THE SOUTH ATLANTIC OCEAN.

THE Meteorological Committee (London) has published a twelve-page pamphlet on the relation between pressure, temperature and air circulation over the South Atlantic Ocean, this being a summary of the facts set forth on a series of elaborate charts published previously by the hydrographic department of